Atmospheric Processes of Alternative Transportation Fuels

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Subcontract Number

YCC-4-14072-02

Performance Period

9/94–1/98

NREL Subcontract Administrator

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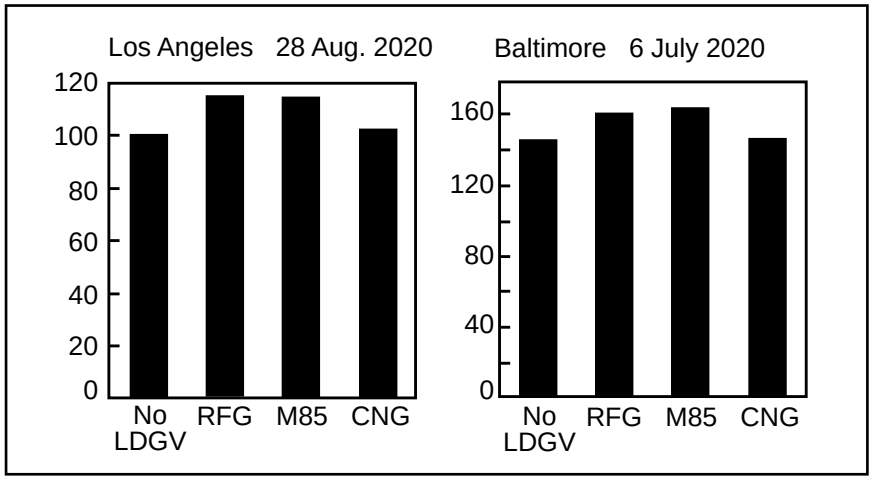
Objective

To examine the potential benefits and impacts on air quality of substituting various alternative transportation fuels for gasoline.

Approach

Systems Applications International, Inc. (SAI) has carried out photochemical modeling to evaluate the relative impacts of three fuels on urban air quality. Under Phase I of this effort we have assembled the required emissions data and conducted photochemical model simulations for reformulated gasoline (RFG), 85% methanol (M85) and compressed natural gas (CNG). The simulations were performed for the Baltimore-Washington area and for Los Angeles. The simulations assumed complete penetration of each fuel in light duty gasoline vehicles for hypothetical conditions in the year 2020 based on projection of existing air quality modeling inventories.

The fleet emissions inventories were based on high-end estimates of mobile emissions in order to maximize the ability to differentiate effects between fuels. The speciated emissions were based on the latest data available through the Alternative Fuels Data Base derived from Federal fleets operating current technology vehicles. The model simulations were compared on the basis of ozone (O_3) concentrations and concentrations of mobile source air toxics. A simulation without the light-duty gasoline vehicle emissions was also performed to generate a standard of reference.



Simulated ozone levels (ppb) under four different fuel scenarios

Accomplishments

We have completed Phase I of this project and reported on the comparison of the three Phase I fuels. Results for maximum ozone concentrations are illustrated in figure 1. The air quality impacts of using RFG and M85 are nearly identical (including the effects on air toxics, not shown here), while substitution of CNG as the available motor fuel offers notably reduced levels of ozone and toxics. The results are entirely consistent for both cities modeled.

Future Direction

We will now proceed to Phase II of this project, which will assess the sensitivity of the Phase I results to alternative assumptions in the development of the inventories and conduct of the photochemical simulations.

Publications

Guthrie, P., Ligocki, M., Fieber, J., Yarwood, G. 1995. NREL Alternative Fuels Phase 1 Modeling Protocol. Report to the National Renewable Energy Laboratory for Subcontract 14072-02. February.

Guthrie, P. "Atmospheric Processes of Alternative Transportation Fuels," presented at the DOE Contractors Coordination Meeting, Dearborn, MI, October.

Guthrie, P., Ligocki, M., Looker, R., Cohen, J. 1996. Air Quality Effects of Alternative Fuels. Phase 1 Draft Report to the National Renewable Energy Laboratory for Subcontract 14072-02. October.